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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,666	09/14/2000	Jianmin Qiao	5298-04100/PM00012	9202

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EXAMINER

PHAM, THANHHA S

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 06/04/2003

14

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

09/661,666

Applicant(s)

QIAO ET AL.

Examiner

Thanhha Pham

Art Unit

2813

-- Th MAILING DATE of this communication appears on the cov r sheet with the correspond nce address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 May 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 7-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

This Office Action responds to Applicant's Amendment in Paper No. 13 dated 5/20/03.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

1. Claims 1-5, 7-8, 10-11 and 14-16 rejected under 35 U.S.C. 102(e) as being anticipated by Ko [US 6,337,285].

- With respect to claim 1-2, 11 and 15, Ko, figs 1, 3-5 and col 1-8, discloses the claimed method for forming a semiconductor device comprising steps of:

forming a dielectric layer (24, fig 3, col 5 lines 29-61) on a semiconductor topography in one processing step **[claim 11]**, wherein the semiconductor topography comprises a gate structure (30, col 5 lines 41-48) formed on a semiconductor layer (12), wherein the semiconductor layer comprises isolation regions (14, figs 3 and 1, col 6 lines 34-43 and col 2 lines 20-49) and wherein the dielectric layer (24, fig 3) is in contact with a sidewall spacer (32) of the gate structure (30) and the semiconductor layer (12) **[claim 15]**, said dielectric layer is substantially continuous **[claim 2]**;

etching a first portion of the dielectric layer (fig 4, col 5 lines 62-67 and col 6 lines 1-22, particularly col 5 lines 65-67 and col 6 lines 1 & 21-22) formed on the semiconductor topography with a first etch chemistry, wherein the first etch chemistry is substantially free of hydrogen and comprises C_4F_8 **[claim 1]**; and

etching a second portion of the dielectric layer (fig 5, col 6 lines 36-57) with a second etch chemistry different from the first etch chemistry, wherein the first and second etch chemistry are selective to silicon nitride **[claim 1]**.

- With respect to claim 3, Ko (figs 3-4) teaches an interface does not exist between the first and second portions of the dielectric layer.
- With respect to claim 4, Ko (figs 4-5) teaches a thickness of the first portion of the dielectric layer is greater a thickness of the second portion of the dielectric layer.
- With respect to claim 5, Ko (fig 4) teaches a thickness of the second portion of the dielectric layer is greater than approximately one half of a height of the gate

structure.

- With respect to claim 7, Ko (col 6 lines 18-19) teaches the first etch chemistry comprises CO.
- With respect to claim 8, Ko (col 6 lines 34-57) teaches the second etch chemistry comprises at least one hydrogen-containing compound.
- With respect to claim 10, Ko (col 6 lines 52-57) teaches the second etch chemistry comprises CHF₃.
- With respect to claim 14, Ko (col 5 lines 49-52) teaches the dielectric layer (BSG) comprises a doped silicon oxide having a phosphorous concentration of less than approximate 6 wt. %.
- With respect to claim 16, Ko (figs 4-5) teaches etching the first portion of the dielectric layer exposes an upper corner of the sidewall spacer (18, fig 4) and etching the second portion of the dielectric layer exposes the semiconductor layer (12, fig 5).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 9 and 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ko [US 6,337,285] as applied to claim 1 above, in further view of Ko [US 6,117,791].

- With respect to claim 9, Ko ('285) substantially discloses the claimed method comprising steps of etching the substantially continuous dielectric layer of doped silicon oxide using the first etch chemistry and the second etch chemistry except teaching the second etch chemistry comprising $C_2H_2F_4$.

However, $C_2H_2F_4$ is a well-known etchant material to etch dielectric materials. $C_2H_2F_4$ is a well-known material which has been used to improve etching selectivity while etching a dielectric layer. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Moreover, Ko ('791) teaches that $C_2H_2F_4$ is an improved etchant to etch a dielectric layer of doped silicon oxide selectively to both undoped silicon oxide and silicon nitride. It would have been obvious for those skilled in the art to modify the process of Ko ('285) by using the second etch chemistry comprising $C_2H_2F_4$ as being claimed, per taught by Ko et al ('791), to form an improved self-aligned contact with a better-control-etching process to make a better device.

- With respect to claims 12-13, ranges of relative etch selectivity are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a

process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

3. Claims 1-5, 7-8, and 10-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al [US 6,025,255] in view of Sung et al [US 5,631,179] and Yanagida [US 5,314,575].

- With respect to claims 1-2 and 11, Chen et al, figs 4's and col 1-6, discloses a method for forming a semiconductor device comprising steps of:

forming a dielectric layer (28, fig 4D, col 5 lines 24-35) on a semiconductor topography in one processing step [*claim 11*], said dielectric layer is substantially continuous [*claim 2*];

etching a first portion of the dielectric layer (fig 4E, col 5 lines 38-58) formed on the semiconductor topography with a first etch chemistry, wherein the first etch chemistry comprises C₄F₈ [*claim 1*]; and

etching a second portion of the dielectric layer (fig 4F, col 6 lines 9-24) with a second etch chemistry different from the first etch chemistry, wherein the first and second etch chemistry are selective to silicon nitride [*claim 1*].

Chen et al does not teach etching said first portion of the dielectric layer with the first etch chemistry substantially free of hydrogen.

However, using etch chemistry substantially free of hydrogen to etch the dielectric layer selectively to the silicon nitride has been known in the art. See Sung et al (figs 2G-2H and col 6 lines 16-63) as an evidence which shows using the etch chemistry substantially free of hydrogen to etch the dielectric layer (30) selectively to silicon nitride. Moreover, Yanagida teaches etching the substantially continuous dielectric layer using a two-step etching wherein the first step of etching using the first etch chemistry substantially free of hydrogen to etch the first portion of the substantially continuous dielectric layer with a high rate of etching.

Therefore, it would have been obvious for those skilled in the art to modify the process of Chen et al by using the first etch chemistry substantially of hydrogen as being claimed, per taught by Sung et al and Yanagida, to etch the first portion of the dielectric layer to form a better semiconductor device with low production cost (high production speed by increasing etch rate) and better quality (good selective etching for a better control production process thereby forming a better device).

- With respect to claim 3, Chen et al (fig 4D) teaches an interface does not exist between the first and second portions of the dielectric layer.

- With respect to claims 8 and 10, Chen et al (col 6 lines 9-15) teaches the second etch chemistry comprises at least one hydrogen containing compound of CHF_3 .
 - With respect to claims 4, 5, 12-14, ranges thicknesses of the first and second portions of the dielectric layer, ranges of relative etch selectivity and range of dopant concentration of phosphorous in the dielectric layer are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted In re Aller 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as temperature and concentration would have been obvious. See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935).
 - With respect to claim 7, CO is a known etchant for etching dielectric materials. See Sung et al as an evidence that show using CO etchant. Selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) "*Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle.*" (65 USPQ at 301.)
- 4. Claims 9 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al [US 6,025,255] in view of Sung et al [US 5,631,179] and Yanagida [US 5,314,575] as applied to claim 1 above, and further in view of Ko et al [US 6,117,791].**

- With respect to claim 9, Chen et al in view of Sung et al and Yanagida substantially discloses the claimed method except teaching that the second etch chemistry comprises $C_2H_2F_4$.

However, $C_2H_2F_4$ is a known etchant for etching the dielectric layer. Selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." (65 USPQ at 301.) Moreover, Ko et al discloses using $C_2H_2F_4$ as an etchant to improve etch selectivity when etching the dielectric layer.

Therefore, it would have been obvious for those skilled in the art to modify the process of Chen et al in view of Sung et al and Yanagida by using the second etch chemistry comprising $C_2H_2F_4$ as being claimed, per taught by Ko et al, to improve the etch selectivity in etching the dielectric layer for a better control in forming a semiconductor device.

- With respect to claim 15 and 16, Chen et al in view of Sung et al and Yanagida substantially discloses the claimed method including using the semiconductor topography comprising a gate structure (26, fig 4D) formed on a semiconductor layer (10) wherein the dielectric layer (28) is in contact with a sidewall spacer (27) of the gate structure and the semiconductor layer (10) [*claim 15*]. Chen et al in view of Sung et al and Yanagida also discloses etching the first portion of the dielectric layer exposes an

upper corner of the sidewall spacer and etching the second portion of the dielectric layer exposes the semiconductor layer *[claim 16]*.

Chen et al in view of Sung et al and Yanagida does not expressly teaches the semiconductor layer comprising isolation regions *[claim 15]*.

Ko et al (fig 1) discloses the semiconductor layer (12) comprises isolation regions (14).

Therefore, it would have been obvious for those skilled in the art to modify the process of Chen et al in view of Sung et al and Yanagida by using the semiconductor layer comprising isolation regions as taught by Ko et al to define active regions in the semiconductor device as a demand of a device is needed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

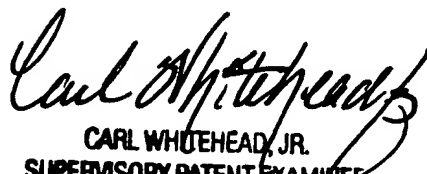
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-3432 for regular communications and (703) 308-7725 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham
May 29, 2003


CARL WHITEHEAD, JR.
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